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If the European War Increases in Intensity Our Labor War Will also Increase. Unless American Industries such as Steel, Motors, Rubber Undertake Major Labor Relations Research Our Labor War will Continue Long After the European War is Over.

Million Dollar Research

Digest and Review

By Charles S. Slocombe

Put three Americans, one Armenian, four Bohemians, three Germans, one Irishman and two Poles together, and set them to work. Let one be so short, "The Runt", that he cannot easily reach the top of his machine; another "Jumbo" so tall that he has to stoop to tend his; one an introvert who likes to work by himself; another who is friendly with everyone; another who has a superiority complex. They will do a surprisingly large amount of work.

But there will be a great deal of friction, argument, antagonism, unhappiness, misunderstanding, inefficiency, restriction of output, and grievances.

How to Get Full Productive Cooperation

The making up of work crews in this way is common personnel practice. As personnel experts, we do not know enough psychology to put the right people together, and they might not stay congenial if we did. Furthermore, most assignment of work is by the supervisory force—who are obviously less capable than personnel men of doing more than a rough job, and who have many other things to think about.

The Western Electric Company is in the process of spending a million dollars on research, to see if and how this sort of thing can be avoided, its effects minimized, and full energy of workers devoted to productive cooperation.

The company makes telephone equipment, and knows the effects of crossed wires, faulty connexions and loose ends on the effectiveness of a telephone switchboard. Having by research and due care banished them from its equipment, it is

having a shot at banishing crossed signals, waste of energy, and mental insulations from among those who make the equipment.

New Personnel Method

As a result of research extending back 15 years, it is now experimenting with a new personnel method, modestly called "personnel counseling". According to the plan there is one counselor to each 300 employees, male counselors for men and female for girls. His job is to see that the relations of each of the members of his flock to each other, and to the supervisors, and between the supervisors is on a cooperative basis.

Having no authority whatever, but merely by understanding and conversation, and putting people together, he spots potential tensions, unconscious misunderstandings, grouches, deteriorations in work, buck passing, attempts to cover up, and quietly sets about to tighten up these loose connexions. "This kind of non-authoritative agency serves to control and direct those human processes within the industrial structure which are not adequately controlled by the other agencies in management."

This last sentence defines exactly why this new personnel method is being tried. The Company's long research has led it to see that the company organization does not make provision for taking care of certain things that should be taken care of—and the studies have pointed out the way in which they can be taken care of.

We have made a rough calculation to see what the possible costs and savings of the program might be. Briefly it would seem that if a counselor raises the efficiency of 300 employees by 1%, the company gets a return of 300% on its investment in his pay.

The Men of All Nations

How did the company come to set up this personnel counseling, and why are they doing it the way they are?

Back in 1931 the company wanted to know what was really going on in its Hawthorne plant, so it persuaded the group of men of all nations, named in our opening paragraph, to work in a room together, under the constant scrutiny of an observer. They were told that they could act just as they would if he wasn't there, and he would not tell the company what he saw, or if he did the company would take no action. They trusted him, and after a week or two acted naturally.

He stayed there for six months, and this is what he saw. There were three groups of three wiremen each, whose job was to attach wires to connexions of a switchboard. Each group of three wiremen had one solderman to solder the connexions. Two inspectors then inspected the work. All fourteen were under the direct supervision of a "group chief", who had other duties and was not in the room all the time.

They Restrict their Output

He observed restriction of output, below what the men could do. They were on a group incentive plan, so were reducing their weekly wages by going this.

It was planned restriction. Any man who did more than the group thought he should was ridiculed, scoffed at and physically punished. The men gave a variety of reasons for this, the most common being the usual one that the company would cut the rate if they did more. None of them had ever experienced a rate cut, and knew that it was the stated policy of the company that a rate is never changed unless the job is changed.

Yet they clung to the view, and there seemed no way by which it could be changed.

They Allow No Improvement

The men had another theory, that each man should keep his output constant from day to day. This did not mean that each man did the same amount, but if one man did 900 connexions an hour usually, that was his quota. The 700 connexion man was not allowed to try to improve, and was criticized if he did less.

Though they received daywork pay, instead of the higher piece work rate, for interruptions not under their control, they reduced their output by deliberately claiming more daywork time than they had.

They also deliberately manipulated their daywork allowance, by working very fast for a while so that the inspector could not keep up with them. Then they rested while he did his work.

They varied the amount of work they reported as done, sometimes reporting more, and sometimes less.

They worked hard in the morning, and slacked off in the afternoon.

Reports on defects by inspectors depended on how friendly they were with the men whose work was inspected.

There was no relation between the output of a man and his ability as measured by dexterity and intelligence tests.

The investigators could not, at this stage, see any special reasons for employees behaving in these ways, which hurt themselves in that their pay was kept down, and hurt the company in that less than full use was made of its plant facilities.

The only theory they could develop was that workers did them because of the relations between supervisors and employees, and among the employees themselves.

They Keep Supervisor under Control

The first line of supervision was the "group chief". His main trouble was that he knew that the boys were stalling, that they were claiming more daywork than they did, and that they were not giving him exact figures as to output. He

furthermore knew that they were not obeying factory rules, that they were helping each other and trading jobs.

What could he do about it? If they gave as an excuse defective materials, and he checked up and found materials were not defective, they would shift ground and blame the inspectors. If he tried to make a personal check on the amount of work they did, instead of taking their word for it, they would cause him all sorts of difficulties and argue with him. If he tried to stop job trading the workers would claim they did it because their fingers were sore, and what could he do about that?

He Goes Along

So he went along with the boys; tried to get them to obey orders as much as possible, but never told the foreman what they were doing. When he got into trouble he made up alibis just as the men did. Because he did this the boys went along with him, and avoided too frequent departures from the rules that might get him into trouble.

In greater or lesser degree the same attitude seemed to prevail as he went up the supervisory ranks to the foreman. There was more overt respect, true, but no greater conformity on the part of the men to factory rules, only an apparent conformity when the foreman was in the room.

So the facts showed that the two way channel of communication, in which orders are transmitted downwards and accurate information as to what is happening on the work line transmitted upward to management was a pretty leaky affair.

Employees did not obey orders, particularly rules relating to conduct. And the information transmitted upwards was essentially inaccurate. These difficulties were primarily due to the fact that employees did not behave, and did not wish to behave as the company expected them to do, when it set up its wage plan. But there was no way the company could find this out, before the study.

The story of the observer's conclusions regarding the relations of the employees among themselves is a most curious and enlightening one. There were friendships, quarrels of greater and less duration, job tradings, horse play, nicknames, such as "Speedking", "Cyclone", "4.15 Special", etc.

One man was not popular because he disliked the restriction of output, another because he "squealed" on the boys to the supervisor, another because he tried to boss them.

They Gang up on College Man

One inspector who was a college man, while the others were high school graduates, was forced out of the room, because he did not fit in with the general ways of thinking and acting of the group. They ganged up on him unmercifully, by all working very hard for a spell, and then standing by, claiming daywork, while he tried in vain to inspect all the work they had done. Then they went at it again,

and again got ahead of him. In retaliation he found many faults. Finally he had to be taken out of the room.

The other inspector was careful not to act in a superior manner, and to go along with the boys, not chalk up too many defects, and enter into their games and talk.

Two cliques formed among the men, one in the front of the room and the other in the back. The "front" boys regarded themselves as superior, as they were, in output. The "back" boys did less than their share of work, though their dexterity tests showed they were quite as capable. These two cliques ran across the planned setup, which was for three groups of men, four in each. A man could not transfer from one clique to the other.

They Make a Set of Rules

The rules of the room were:

(1) You should not turn out too much work. If you do, you are a "rate-buster".
(2) You should not turn out too little work. If you do, you are a "chisler".
(3) You should not tell a supervisor anything that will react to the detriment of an associate. If you do, you are a "squealer".
(4) You should not attempt to maintain social distance or act officious. If you are an inspector, for example, you should not act like one.

A man's position in a group was determined by the extent to which he obeyed the rules of his clique. The front clique obeyed all of them, and the back clique disobeyed No 2.

The general theory of this grouping of workers, and the rules they work out, is that they are to protect them from outside interference by the company or its supervisory representatives, and also to protect them from internal indiscretions.

(Note. The above conditions, though they may look like it, do not imply poor management. These men were wiring over 6,000 connexions each a day, whereas the output for other companies doing the same kind of work was 4,000 per man per day. But in the Western Electric Company, 100 per cent efficiency on the part of these men would have produced 7300 connexions per man per day, without undue fatigue. The company was trying to find out why it did not get the 7300.)

The six months' period of observation came to an end in 1932, when the men were laid off owing to the depression. During the interim period the investigators had a chance of going over their notes, and figuring out what should be done about such situations when business picked up.

Personnel Counseling Invented

It was then that they invented "personnel counseling". We can see better from what went on in this bank wiring room what a counselor has to do.

He must know what cliques and groups there are among workers, what the

rules and regulations of these groups are, why they were formed; the relation of each worker to each group, why he is in it, and how it affects his conduct; and finally the relation of each group to the supervisors, and of the supervisors to each group.

Then his job is to try to make the rules of the groups more logical, to see that the supervisors understand them, their strength, and how to deal with them, to interpret individuals' difficulties in their adjustment or lack of adjustment to the group in which they find themselves, and finally to advise the company in matters of policy, to avoid stirring up group antagonisms.

Specific examples would be:

When a new supervisor comes into a section or department ordinarily he has a difficult time for some months, because he hasn't the picture of all these things—so the counselor helps to put him wise.

When a bright ambitious employee is placed in a clique, with rules limiting output, the counselor must watch to see that his ambitions are not frustrated, and yet that he does not get on the outs with the group.

When an employee's performance falls off the counselor seeks out the reason, and helps to remedy the situation.

All these things he does, by virtue of his knowledge, the strict confidentiality of matters told him, his lack of authority, and the respect of the employees which he earns. He does them to increase productive cooperation.

Why did the company put the fourteen men of mixed nationalities in the room together and observe what they said and did?

Partly as a result of its thought that there were unused stores of latent energy and productive cooperation, which could be obtained from the workers under the right conditions, and partly to obtain better material for foreman training, in 1928 the company started to interview all employees in the plant.

The company apparently thought that the interviews would aid in releasing this unused energy and cooperation.

40,000 Complaints

THERE are grounds for thinking that it did, somewhat. But it certainly released a mightly flood of grievances, complaints and unfavorable comment about company policies and practices. 10,300 employees turned in 86,371 comments, of which 41,892 were unfavorable, an average of four unfavorable comments per employee.

"It was startling to find the number of employees who had nursed for many years grievances which they never had an opportunity of expressing to any person of authority in the company. Many of their grievances were trivial in nature, but they were of real importance to the worker."

It was perfectly obvious that the company could expect no large release of latent energy or productive cooperation while these complaints existed.

We show an abbreviated tabulation of these grievances or unfavorable comments in Table I (below).

It must have come as something of a shock to the company to hear the number of things the employees did not like about its personnel policies.

For years the company had tried to line up the best personnel practices, good wages equitably determined, proper hours, a clean well lit, well ventilated plant,

TABLE 1

SUBJECT UNDER DISCUSSION	COMMENTS		
	Per cent unfavorable	Number unfavorable	Total number
Material	97	1241	1283
Smoke and fumes	95	1064	1118
Lockers	92	3540	3846
Piecework in general	92	1123	1225
Working space	91	952	1042
Washrooms	87	2044	2352
Sanitation	87	960	1105
Rate revision	87	1541	1767
Piecework rate	87	1510	1713
Furniture and fixtures	83	1035	1246
Temperature	83	1120	1345
Tools and machines	81	1281	1584
Safety and health	80	3208	4029
Group piecework	79	1034	1309
Output bogey	66	1382	2093
Light	65	1689	2598
Supervision	61	2737	4605
Ventilation	59	1524	2561
Fatigue	58	1311	2275
Promotions	57	816	1423
Dirt	48	1297	2699
Hours	44	2273	4285
Wages	28	1284	4499
Hospital	22	481	2195
Placement	17	1506	8827
Welfare work	15	322	2121
Club activities	11	379	3333
Thrift plans	5	305	5809
Vacation plan	4	173	3723

with the best tools and materials engineering science could provide, and extensive health, safety, recreation and welfare programs.

Yet the employees didn't think much of all this—or at any rate were pretty critical. What was the matter? Had the people charged with carrying out the program been slack, so that a "shake-up" of the kind that periodically overtakes police departments was necessary? Was the program unbalanced, or improperly designed that it was shooting so wide of the mark?

These and other questions came up for answer. Interviews were analyzed forwards and backwards, statistically, psychologically, psycho-pathologically and

according to the rules of social anthropology. Meantime, surveys of all plant conditions were made. Personnel practices, including foremen's abilities, were analyzed thoroughly. Changes found necessary, mostly of a minor sort, were made.

But, without excusing itself in any way, the company simply could not find, either in the physical conditions of the plant, or in the general personnel setup, any sensible reason why so many employees were dissatisfied about so many things.

Few Workers Agreed about Anything

Analysis of the interview notes showed that while there might be more agreement among the employees in a department about some physical condition, such as the lighting, than there was about whether they liked the foreman, yet even about objective matters there was much difference of opinion. In fact this was the outstanding point that showed up. Employees did not agree about anything.

It is more or less easy to understand why two workers might have different views about a foreman. But why should it so frequently happen that two employees of about equal ability, both with good eyesight, doing the same sort of work should have different views about the adequacy of the lighting? If they do, why do they?

Psychologists Dig Deep

The psychologists dug pretty far down into the realms of the unconscious, and far across into the mysteries of social interrelationships, to find the answer to this question, and an explanation of the anomalies that the whole program had exposed. They could not find the answer by theorizing, so finally designed the plan of putting the fourteen workers together in a room, and observing their conduct, in the hope that that experiment might provide it.

There they did get the answer, for example:

The complaint that one of these men might make about the group piece rate system was seen to be due not to any basic fault in the system itself, but to the fact that he wanted to turn out all the work that he could, while the rules of the clique he worked with did not permit him to do so.

The complaint that a worker in the back of the room might make about the temperature was not due to any fault in the ventilation, but to the fact that the man wanted to get up to the front of the room, where the "aristocrats" worked.

It was a tradition, perhaps based on actuality in the past, that the men up front were better workmen than those in back. So the fellows up front worked harder and maintained the tradition, though they were really no better than the men in back. The men in back were held back psychologically in their output because they were supposed to be inferior. So the men in back made complaints about wages in general. The men up front made few.

It is all very silly—but it is how things are, until they are corrected at their base. This the company hopes to do by its personnel counseling.

Early Light Experiments

How did the company come to start on this million dollar research? It did not make up large plans and then budget for them, but started in a very simple way, and kept going as seemed desirable.

It started, in 1924, by cooperating with the National Research Council in a study of the "relation of quality and quantity of illumination to efficiency". Three sets of experiments in increasing and decreasing the amount of light were made over a period of three years.

In the first, output increased with increasing intensity of light, but not regularly. In the second, where a control group working under constant light was compared with a group of workers under increasing light, it was found that both groups increased output. In the third, while the light in the control group was held constant, the light for the experimental group was decreased. Output for both groups increased.

Screwy Results Obtained

These results were "screwy". Light by itself must be only a minor factor in efficiency. This was confirmed when two girls were put in a locker room, the light turned out, and only a little light allowed in, such as might come in through a crack in the door. The girls maintained their efficiency.

After this experience the company decided on further research to try to find out what really would cause changes in efficiency. So five girls were put into a room to work together. All sorts of changes were made, in rest pauses, wages, methods, hours, etc. Production kept on going up, and the company began to see the first glimmerings of the complication of factors involved.

It was then that it concluded that there must be a vast amount of employee energy and cooperation not being used under ordinary factory working conditions, and set up its vast interviewing program to see if that would release these energies.

Tries at Releasing Energy

The interviewing program did not release much extra energy, but it did release an unexpected flood of complaints. No satisfactory explanation for the complaints, with all their contradictions and inconsistencies being found, but it being evident that they were responsible for the lack of full cooperation, the experiment with the fourteen men was tried. This provided a theory to explain complaints.

So through the method of "personnel counseling" the company is now testing out the theory, trying to reduce dissatisfactions, and release the latent energies and full productive cooperation of its employees.

Company Executive's Viewpoint

For fifteen years these studies have been going on, studies which we estimate will have cost the company well over a million dollars before they are completed. What has the company got out of them? It appears to have made no financial measurement, and is very modest in its claims, as witness the statement of Mr. C. G. Stoll:

> One may well ask what success our management has had in applying these developments to the human problems of the business, since this is a phase of the work not directly discussed by the authors. Throughout the course of these studies, the points of view which were emerging were frequently lifted out for application to current situations. At the Hawthorne Works, where the studies were made, there was continuous use of the better understanding of human reactions which was developing, not only in dealing with specific situations but in training supervisors in more human and effective methods of dealing with their workers. Much experience has been had in trying out and testing the findings of this research in real work situations and it seems clear that the knowledge acquired has been increasingly helpful in our efforts to create a better relationship between supervisors and workers, the kind of relationship which contributes naturally to proficiency and a high state of morale.

We have made some rough calculations, based on the printed figures available. They seem to indicate that if the personnel counseling program is applied to ten thousand employees, increasing their average output by 1% the gross gain would be $300,000 a year. Part of this would go as the cost of the counseling, another part to employees in increased earnings, and the balance to the company in reduced labor costs.

As near as we can calculate, if the fourteen wire and soldermen had not restricted output, they would have done 11% more work. If we assume that under normal conditions the company would have 40,000 employees on its payroll, and calculate the gross gain if the program were successfully applied to all, and raised output to the maximum, then the gain would be over $12,000,000. The company can reasonably expect to get some portion of this, and is thus certain to get back its investment in research.

The Art of Human Collaboration

But perhaps monetary considerations are not the most important ones in research of this kind, for as Elton Mayo says:

> Can anyone doubt the need for inquiries of this type? The spectacle of Europe, erstwhile mother of cultures, torn from end to end by strife that she can by no means resolve, should give pause to the most "practically-minded", should make such persons ask what type of research is likely to be most practically useful at the moment. The art of human collaboration seems to have disappeared during two centuries of quite remarkable ma-

terial progress. The various nations seem to have lost all capacity for international co-operation in the necessary tasks of civilization. The internal condition of each nation is not greatly better; it seems that only a threat from without, an unmistakable emergency, can momentarily quiet the struggle of rival groups. In this general situation it would seem that inquiries such as those undertaken by officers of the Western Electric Company have an urgent practical importance that is second to no other human undertaking. How can humanity's capacity for spontaneous co-operation be restored? It is in this area that leadership is most required, a leadership that has nothing to do with political "isms" or eloquent speeches. What is wanted is knowledge, a type of knowledge that has escaped us in two hundred years of prosperous development. How to substitute human responsibility for futile strife and hatreds—this is one of the most important researches of our time. It is our hope that the inquiries described in this book are the beginning of a small contribution to such knowledge.

Management and the Worker

THE above is a digest and review of "Management and the Worker", by F. J. Roethlisberger and William J. Dickson. (Harvard University Press, Cambridge, Mass. 615 pages. Price $4.50.)

The book describes, in full detail, all the studies in the Hawthorne plant of the Western Electric Company right from their beginning fifteen years ago. It is the first time we have had a full account of them.

For the purpose of logical scientific presentation the authors describe the studies in chronological order. For our digest we have read the book Chinese fashion, starting with the last chapter, and working forwards. We have an idea that they might have written a more interesting book, if they had not been so logical in the order of their presentation, and had included much more material about their current work.

This is unquestionably the most outstanding book on industrial relations that has yet been published anywhere, anytime. We do not see how any personnel man can expect to meet the critical labor problems of the immediate future without having read it, and without applying to his own situation the principles set forth in it.

We May Study Psychology or Sociology, but We Shall probably Never Know What Goes on Inside a Worker's Brain. But We Can, by Scientific Study Learn How to Plan Our Relations with Him in a Better Way then We Do Now.

Industrial Uses *for* Applied Psychology

By Cecil E. Goode
Federal Housing Administration
and Otis C. Trimble
Purdue University

Interest in determining the areas in industrial personnel administration in which psychology might prove to be of most immediate service led to the present survey. The general aim was to define directions in which instruction in industrial psychology might approach the more immediately practical aspects of personnel work and in which research in the field might yield more directly applicable results.

Five Most Important Problems

The obtained results indicate that the five most promising areas are:

(1) The selection and placement of workers, with reference to improvement in the methods involved.

(2) Supervision of industrial processes, with the development of better methods as the objective.

(3) Job training, for the development of greater efficiency and personal satisfaction.

(4) Worker-security for the development of a more satisfactory outlook.

(5) Worker-opportunities, for the improvement of chances to exercise initiative and leadership.

The initial problem was that of determining the major areas of human problems in industrial management, and next that of discerning the most pressing problems at the present time for effecting better industrial relations. Two different criteria were used:

(1) The extent to which given human factor problems were dealt with in

published works in the fields of personnel administration, industrial psychology, labor economics, and industrial engineering.

(2) Ratings as to the relative importance of stated problems in the field, by industrial personnel administrators, non-personnel industrial administrators, teachers, consultants, writers, and students.

The first step in the procedure consisted of the examination of twenty-nine different books in the fields indicated above. The tables of contents of these books were studied for topics bearing upon personnel work. In this way the preliminary list of problems was made up. Then the relative significance of the different problems was determined by computing the average amount of space devoted to them by the authors.

Finally, twenty-three of the problems evaluated by the above procedure were selected and submitted in questionnaire form for rating. Eighty-five personnel technicians and administrators, forty-nine factory employees, and forty-one university students served as raters. Each rater evaluated the different problems in the list, by the use of a suggested five-point scale with steps as follows: (1) *very important;* (2) *above average importance;* (3) *average importance;* (4) *below average importance;* (5) *not important.* The problems were rated as to importance for the improvement of personnel relations in the future.

In order to secure a more or less generalized statement from the raters and at the same time obtain some indication of the reliability of their ratings, each rater was instructed to list in the order of importance, with the most important first, the five problems in the whole list which they considered to be the most important.

Personal Problems Head List

THE obtained results are presented in Table I. Here the rank order of the problems is shown, based upon the ratings obtained from the different groups. Also, general indications as to the extent of agreement among the groups is to be observed.

These results clearly indicate the relative importance of the different problems, as judged by the different groups. It appears, according to those best qualified to rate the problems, namely personnel men in industry, that problems in the methodology of selecting and adjusting the worker to his work are of very great importance for the improvement of personnel relations; while the problems that are removed more and more from the immediately personal in the work situation are less and less important. "Improved methods of selecting and placing workers", "better methods of supervision", "development of better training methods", "development of a more nearly secure future", and "chances to show initiative and leadership" are ranked as of the greatest importance; while "better home conditions", "better community conditions", "reductions of distractions such as noise, vibration, etc.", "development of recreation and entertainment", and "reduction of monotonous operations" are rated as least important.

Present and Anticipated Needs

IT IS to be noted and kept in mind that these problems were evaluated with reference to the future, that is, with reference to improvement in personnel relations in industry. The ratings probably indicate the present status of conditions in each area as much as they indicate anything else. They indicate present and anticipated needs. The rating of problems in the selection, placement, and adjustment of workers to the work situation as of greatest importance, for example, does not

TABLE 1

RANK ORDER OF PROBLEMS ACCORDING TO THEIR ESTIMATED EFFECTIVENESS FOR IMPROVING PERSONNEL RELATIONS IN THE FUTURE

RANKED BY PERSONNEL EXPERTS (85)	RANKED BY				
	Personnel Administrators (41)	Non-Personnel Administrators (23)	Academicians (21)	Psychology Students (41)	Books on Personnel Administration (29)
1. Improved methods of selecting and placing workers	3	2	1	1½	1
2. Better methods of supervision	2	1	2	10	11½
3. Development of better training methods	1	4	4½	7½	3
4. Development of a more nearly secure future	4	3	3	1½	8
5. Chances to show initiative and leadership	8	5½	6	3	20½
6. Development of collective bargaining or cooperation for workers	5	12	4½	20	5
7. Improved methods of promotion and transfer	7	7½	9	16½	13
8. Better adjustment of employees to the job and the working environment	6	5½	10	5	9
9. Better accident prevention programs	9	7½	12	13½	7
10. Job analyses and job specifications	10	10	11	6	6
11. Development of methods of testing and rating	11	15	7	4	2
12. The learning by workers of how to get along better with other people; social adjustment	12	11	8	11	19
13. Improved illumination	14½	9	14	7½	20½
14. More attention to health service	13	16	14	9	10
15. Development of time and motion study methods	16	13	17½	20	14
16. Improved methods of pay	14½	17	16	20	4
17. Elimination of fatigue	18	18	14	12	11½
18. More consideration to atmospheric conditions	17	14	21	16½	22
19. Better home conditions	19	19	17½	13½	16
20. Better community conditions	21	20	20	18	17½
21. Reduction of distractions such as noise, vibration, etc.	22	21	19	15	23
22. Development of recreation and entertainment	20	22	22	22	15
23. Reduction of monotonous operations	23	23	23	23	17½

indicate that personnel men have not recognized the importance of getting the right man for the right job, but rather it indicates a pronounced interest in meeting specialized requirements in job-performance with as little waste of the human factors as possible. Or, the rating of problems in the reduction of monotonous operations as of least importance does not mean that such problems are unimportant; rather, it may mean that the industrial process has already been adjusted to take care of the major needs in this direction.

In any case, it would seem that persons who are interested in personnel work

in industry would find their most immediately practical opportunities in work toward the improvement of: (1) methods of selecting and placing workers; (2) methods of training and supervising the worker in his tasks, and (3) the personal adjustment of the worker to his job.

1. Professor James P. Porter of Ohio University, Professor Russell J. Greenly of Purdue University, and the Duncan Electric Manufacturing Company of Lafayette, Indiana, co-operated in gathering the data for this study. For this assistance, the writers express appreciation.

2. Reliability coefficients for the judgment of the various groups are: for personnel administrators, .94; non-personnel administrators, .84; academicians, .88; psychology students, .89.

Neither Employee nor the Companies Would Really have Wished to Bring about the Dreadful State of Affairs Here Depicted—Affecting Ambitions, Home Life, Community Relations. What Similar or Other Desirable or Undesirable Conditions May be Produced by Rigid Rules in Industry.

The Seniority Curse

By Fred W. Cottrell

University of Miami
Oxford, O.

There are many unsatisfactory and unwholesome conditions among the million men in the railroad industry. These conditions impair efficiency, constitute an economic waste from the point of view of both the railroad companies and the workers, and create a dangerous, unsettled human situation which helps spread unrest.

Few railroad men can be said to be well adjusted to their surroundings. Few have the feeling that they are important; that life has enriched them with what they need to make existence satisfying to themselves.

"Boy, Keep Away from the Railroad"

This is true despite the fact that superficially it would seem as if railroadmen, protected by their unions, are very much satisfied with themselves and with their work. Their deprecating remarks concerning railroading as a career are generally taken by an outsider to be part of a modest pattern of behavior that has little or no relationship to actual attitudes entertained. It would seem as if their remarks expressing dissatisfaction with their lot could have little relationship to the security and good working conditions which they seem to enjoy. "Boy, keep away from the railroad"; "Thirty years on the railroad, and what have I got to show for it?"; "If I had it to do all over again, I'd keep the hell away from the railroad"; are but a few of the expressions heard from engineers, firemen, trainmen, and signal station operators.

These expressions represent real dissatisfaction, not superficial verbiage, to most of the railroadmen making them.

Young Workers Become Disillusioned

DESPITE a system of seniority that would seem at first glance to make the older men secure, there is much lacking in the security of the average personality on the railroad. It comes as a surprise, to an outsider, to know that most railroaders are afraid of promotion; that changes in their routine work are promoters of anxiety. Upon first receiving work on the railroad, a young man tends to have rather strong incentive to do his job well, desiring greatly to make an impression upon his superiors. He is eager to learn and is, as a rule, self-confident in his ability to do his work well. As time goes on, he tends to lose confidence in his own ability. He often becomes thoroughly disillusioned, disgusted, dissatisfied.

What are some of the causes of this dissatisfaction? And what are the remedies? In seeking the answers, let us first get a picture of the different classifications of railway labor.

Among railroadmen, the "Big Four," engineers, firemen, conductors, and trainmen are organized into the strongest unions. They regard themselves as the "aristocrats of labor" in America. In their view, all other railroad workers fail in some detail to qualify fully as railroad workers.

Machinists, boilermakers, and other shop men rate next to the Big Four in the hierarchy, then come bridge and building, telegraph, signal and telephone workers, section men, and finally, hardly recognized as railroad workers at all by the other men—the clerks.

We immediately notice two curious facts. The members of the Big Four regard themselves and are commonly considered as unadaptable to all other occupations, in the life of the nation. At the other end we have the clerks, who though looked down on by the Big Four, nevertheless have a knowledge of accounting, filing, stenography, etc., which make it possible for them to gain employment in practically any business. In between, we have other groups, which may or may not be qualified for employment in other industries.

The Big Four

THE Big Four, most closely tied to the railroads because of their real or imagined uselessness in any other walk of life, base their claim to aristocracy on the fact they are the most loyal unionists in the country. The strength of this loyalty is doubtless due to the conviction that their union is their sole protection for their sole means of livelihood.

On the other hand the despised clerk, poor devil, is the least loyal to his union, having the least need to lean on it, to protect his job.

In between, are the shopmen and others, varying in their status as railroaders as their degree of freedom decreases and loyalty to their unions increases.

A Dangerous Union Rivalry

It is a peculiar and unexplained fact in all this that the chairman of the socalled Railway Labor Executives Association, the co-ordinating bargaining agency for the 21 railway labor unions, is the president of the union of the despised clerks. Of course, his influence is disputed by the trainmen, who, in the last wage negotiation, insisted on their own separate agreement. Unquestionably the rivalry between these aristocrats and their inferiors among railroad men will delay rehabilitation of the roads under the joint committee with management.

What a strange state of affairs! Let us realize the situation in more detail.

As their major protective device, the railway trainmen work under strict seniority rules. These appear to have been set up initially to protect the men against what they feared might be discrimination and favoritism by the company in the early union days. But it is evident these rules were intended also for protection of one craft against another and even one worker against another. There has since been added to these explanations the theory that the older men have a greater right to the jobs than the younger, in fact that a man invests his time in his job, and the size of his investment which is spoken of by railroad men as a property right, is proportional to his time on the job

These views of seniority and job rights are probably in part merely normal developments of a social group and partly rationalizations. The adoption of rigid rules implementing them however, would appear to have turned out to be the worst curse that could have descended on the trainmen themselves.

Agonies of the Seniority System

There follows extracts from a research report in the railroad field, to show how badly and how inhumanly the present system actually works:

The bulk of firemen and brakemen are recruited locally and tend to accumulate seniority on the division on which they "broke in" or received their student training. Seniority for train and enginemen is usually confined to a single division and transfer is extremely costly. As a student a fireman or brakeman is assigned the least desirable runs and is constantly on the move. Today he is working out of this point, in place of an absent regular man, tomorrow he may be deadheaded to some other point to handle a work train. Next month he may be idle only to be called on short notice to bring in a train that was too long delayed, to handle an extra glut of business or work connected with a derailment, washout, or other emergency.

He must be available to the "caller" at all times to go wherever business demands. When he finally makes the "extra board" at a particular division point he usually will have had temporary sojourn in all points on the division.

If he has any consideration for women he will delay marriage until he can expect at least a regular pay check and some definite stay at a given point. When he marries it is likely to be to a girl much younger than himself. But in the meantime the morality of his associates, and his break with most of the controls which affected him while a permanent member of a family and geographic community, usually serve to cultivate a growth of wild oats to be harvested by the novice. Habits so acquired are not easy to break, even after marriage, when frequent "bumps" make it impossible to move wife, furniture, and the accoutrements of conventional living as frequently as the job changes.

Many times an assignment to a "work train", a branch line, or "extra section" of a regular train is for a definite but short period, and the expense of moving to permit family life to go on is not justified by the duration of the job at that point. The mobility of such early years is hardly a promising foundation for marital fidelity or conventionality. When the more stable basis comes, stay at any one point is definitely terminable.

Lines of Promotion Fixed

USUALLY promotion runs from freight fireman to passenger fireman, to freight engineer to passenger engineer, or similarly for the brakeman and conductor.

Hardly has a man earned a good permanent run before he is again "geographically demoted" by being required to take a less desirable location but advanced rank or required to give up his "running rights". Slowly he again earns the right to permanent location in a "good" town, only to be sent into the "sticks" in passenger service, to work up and again be torn up by roots and redeposited.

Frequently he may be required to move because of a change in the number of trains, necessitated by business conditions or technological improvements, change in rank due to death, discharge or pension of someone higher up on the lists, or the fact that someone with more "whiskers" has an opportunity to "bump" back to a point to which, for one reason or another, he had formerly refused to bid.

Twelve to 50 "Bumps"

A MAN in the train service may normally expect at least a dozen such changes in location of his home terminal, and the number might, during transitory times such as those occasioned by war, depression, geographical shift of industry and technological upsets, easily reach fifty "bumps" during *continuous* employment.

This mobility accentuates the difficulties of marital adjustment. It is dangerous to obey the injunction of the real estate dealer and purchase a home for it frequently must be rented or stand idle while the head of the house is acquiring the "seniority" to return to the terminal in which it is located. Neither alternative is particularly desirable. If the house be rented the renter will want assurance that he will not be

forced to move which, if given, means that home ownership has offered no advantage to the owner. If he doesn't give the renter a lease a less satisfactory tenant, who himself may be "bumped", is likely to be acquired with unsatisfactory care of the property probable. The other alternative to leaving the house idle is for the mother and children to occupy it permanently while Dad is "bumped" about until he can again live at home.

Thus separations occur that after some time may gradually merge into desertion or divorce.

If he rents, the road man suffers again from his mobility. Landlords know that every change of tenant involves additional expense, idle waiting time, new demands, and that highly mobile tenants are not likely to take good care of the property. So the railroader pays a high rent for inferior housing, which is far from the character usually associated with persons of the same income permanently located. If the furniture is rented it will seldom be well cared for, and if he purchases his own the constant moving, packing, and consequent breakage, refitting and relocating will quickly reduce even good furniture to mediocrity.

There is at best little satisfaction in entering civic affairs in a community from which you may at any time be removed. Work on schools, recreational facilities, churches, or other local facilities is seldom a part of the activities of these railroaders.

What may be purchased through gift of money can easily be secured in the railroad town. What involved careful long-time planning, continuous personal interest, enthusiastic participation, painstaking administration will be noticeable by its absence.

The railroader, like many urbanites, regards the provision of public service as a purchasable commodity, to be secured through the pecuniary nexus: Taxation, admission fee, or public contribution seldom arouse active opposition, but this is the extent of public duty to mobile railroaders. In the community, but having no permanent stake in it, they expect to pay their way as they go along, and let others do likewise.

To occupationally connected groups, such as women's auxiliaries, lodge benefits, or collections for the dead, injured, or indigent, they give generously and make few demands for an accounting. They lend little support for *county* children's home, *municipal* welfare programs or other public activities.

Railroad Men Provoke Community Hostility

THIS fact is productive of hostility amongst the small business men, church leaders, and other civic volunteers who emphasize the importance of Main Street's program for schools, churches, streets and parks. It is the subject of much condemnatory gossip, and is reflected in the jealous envy with which the expensive cars and dress of the road man's wife and children are greeted. It is summed up in such caustic comment as "they can buy a new car every year but they never give a

nickel to the church." The soul of the railroad man is highly affected by his mobility.

"We can't plan to have Johnny in the Christmas play because his father may be 'in' right then and we want him to be home." "Mary can't promise to come at that time because her father may want his dinner and he likes to have the children at meals." "I can't join the bridge club because I want to be with John when he is home and I might have to miss too many times." "We did want to have Sunday dinner with the Browns but Will is going to be out and we have to have our dinner Saturday night instead." "We'll go to the benefit if John is in and has his rest, but I can't buy a ticket because he may want to sleep." "We don't want to sign up for that series because you never know whether you can go or not." "The boys were *so* disappointed. They planned to go fishing with their Dad on the Fourth but there was an excursion and he had to take it out." "I had the nicest Easter outfit and then we couldn't go to church because Henry was called at nine o'clock."

These are typical of the irritations which beset the life of the railroader's family when he is still on unscheduled freight or the extra board, which usually occurs while his family, if he has one, is young, and when the demarcation which this sort of life serves to make between the railroader and others, and between various railroaders, is most important.

Meals may be required at any hour; sometimes two or three series of meals in a day must be prepared depending upon school schedules and those of men on various shifts. Car inspectors, for example, eat their lunch when they can get it. The noon meal may come any time between eleven and three, depending on the arrival of non-scheduled extra trains, or the amount of "running repairs" that have to be done.

Community Participation Impossible

THE rest of the community,—its schools, its churches, lodges, bridge clubs, official meetings of boards of trustees, town councilmen, benefits, socials, theaters, run on a time schedule, that is much more definite and therefore permits more time-planning than is possible for railroaders who operate trains.

Membership in an organization with regular meetings is difficult to maintain and the socializing effect of such contacts is lost. Forms of recreation that depend upon no collaboration with others must be indulged in. In cities, there are continuous shows, night clubs, and restaurants, taxi dancehalls, and other individualized amusements; in rural area, fishing and hunting, pool parlors or saloons are offered; in both, the ubiquitous crapgame and other forms of gambling.

May See Children Rarely

IF THE wife and mother attempts to make her family an integrated part of the community, she must conform to its timing. Meals must be ready for the children so that they can attend school and Sunday School. Promises as to their

participation in athletics, school government, and extra-curricular activities must be kept. If this be done, it may mean that the husband and father will see the children only rarely. He can expect that at least half the time his rest will come during the time they are sleeping; their whole day is normally taken at school; if his meals cannot be made to coincide with theirs, and frequently if he is to get any sleep they cannot, he may not see his children at all, unless they give up all plans of their own.

The wife labors under a double difficulty. In the absence of the father of her children, she has the whole problem of discipline. She cannot even threaten "When your father comes home tonight" for that may be at three o'clock in the morning. She must be prepared to have meals ready whenever he comes in, which means constant preparation for the unexpected; she seldom knows in which particular meal her husband will share. She cannot plan with any degree of certainty her own recreation or community participation. If she joins club, church, guild, or lodge and takes office, she may incur the displeasure of a husband deprived of what he regards as his right to her time and attention when he is "in."

Family Life Important

If she does not join, she is likely to be deprived of almost all recreation since she is denied the equivalent of the forms of recreation her husband may have, and if she chooses to go to public dances or any other public place where couples are expected, she is immediately suspected by all the "good" people of the community.

Small wonder that family life during this period is frequently so distasteful and disorganized as to rob later years, when a satisfactory "run" has been earned, of most of its satisfactions.

Yet the very situations that make family life difficult also serve to increase the significance of the family in the life of the railroader. In many cases, it is the only group in which he functions, and an idealized attitude toward children frequently results, making for a romantic indulgence of their whims.

Portions of the above paper have appeared in the American Sociological Review. They are reproduced through the courtesy of the Editor.

Though the Paper which Follows the Editorial Comment Below, is More Technical than is Usually Published in the Journal, it is Included to Give a Full Picture of an Excellent Workmanlike Job of Testing, with No Waste Motions, and Nothing Essential Omitted

Hiring Telephone Men *by* Tests

By Nathaniel E. Rossett
and Peter Arakelian
Yale University

The current upturn in business has brought into prominence again the problem of hiring good workers. And so personnel men are again looking at psychological tests, to see what chance there is that these will aid them.

This seems a good time therefore to briefly outline, when to use tests, how to start using them to best advantage, and give an example of how one company did it.

Where Tests Help

The first point is that tests are only useful for jobs requiring a fair amount of skill, and that as a job becomes more complicated ordinary methods of hiring, without tests, are apt to let too many duds through. So look over your job situation to see whether and where tests would help.

If you decide you do need tests, or want to give them a trial, the next question is how to go about it. You have three options, (1) to have someone on your staff qualify himself in psychological testing (which would take the best part of a year of intensive study), (2) hire a psychologist experienced in industrial testing, or (3) obtain the part time service of an industrial psychologist. (A small plant might well do this.)

If you decide to hire a man for the job, be sure to seek the advice of an authority on the subject, and be sure that you budget enough to pay your man sufficient salary. In the last business upturn, three companies failed to take these precautions, hired young inexperienced psychologists, and paid them too small salaries. While

apparently the young men were fair at their job, they left in the middle of setting up the testing, for better jobs, and left the companies high and dry.

You can get good work out of a young inexperienced psychologist, if you have him supervised by an experienced industrial psychologist, acting in a consulting capacity.

With the aid of your employment department, the psychologist will study your job analysis of the jobs you want the tests for, to see what psychological factors are crucial to success on the job. If you have no job analysis he will have to make one, or he may use your training syllabus.

He will then consider what tests there are on the market which might be suitable. He will probably design some extra tests to be used as well—ones which fit the special conditions of your plant. He will then have what he will call a battery of tests. This is always advisable, as a single simple test is rarely accurate or reliable.

Six Months' Work

HE WILL then consult you as to whether there is any measure of workers' abilities in the plant—foreman rating, production records, or examination at end of training period. He cannot tell, and you cannot tell, whether the tests are any good unless he has this.

He will then give his tests, either to new people who are being hired and/or to employees on the payroll. He will then use a variety of more or less complicated statistical formulae to discover whether the tests are any good, which parts of them are good, and the relative importance of the several parts.

He will then take out the dead wood, arrange the scoring so that the most important parts count most, and give you an estimate as to the percentage of men who will do good work on the job at different passing grades in the tests.

He can then go ahead and hire good workers for you.

All of which would probably take the best part of six months, if you give him every possible aid, and facilities in your plant are reasonably good.

Something Simpler

BUT isn't this all too scientific, and mathematical and complicated?'' the reader may ask. Can't we have something simple and practical? Yes, of course you can, if you want to waste your money on it. It won't pick out good workmen for you, even though it may look as though it ought to.

We give two examples, advocated at one of the university industrial relations conferences, where economists give talks on psychology.

An airplane company has a simple practical test which consists of two applicants for jobs turning over wooden disks, painted yellow on one side and black on

the other. The fellow that can turn over the most in ten seconds gets the job. That is all.

It was suggested by the economist that knowledge of this sort of thing should be widely spread, because in some unknown way, it would solve the problem of a skilled labor shortage.

Unemployed Toss Wooden Flap-jacks

We can imagine the employment man, who has to sit and watch the two poor unemployed men who would do anything to get jobs, tossing wooden flap-jacks for dear life, making up little rhymes like:

I diddle dee,
Phlin phlan,
By Gosh, I see
A very good man.

Of course, this sort of medieval mumbo jumbo was tried out and discarded by psychologists long before airplanes were invented. But it is simple and practical, and advocated by economists.

The second case is that of an electrical manufacturing company. Apparently a foreman in charge of the packing room, where girls were sewing burlap wrapping around apparatus, thought the girls were too slow. So he went over to the personnel department with his troubles, and they rigged up a psychological test for him in half an hour.

The Doughnut Spiking Competition

This consisted in having the girls thread little rubber doughnuts on a wooden stick with their left hand, while they picked up some more little doughnuts with another stick with their right hand. The foreman was much pleased, and his troubles with his girls are now reported to be over.

Simple and practical, if you like your tests that way. But why not give the money this sort of stuff costs to charity.

The simplicity and practicality of this doughnut spiking business appealed so much to an oil company personnel man present, that he arranged then and there to send two of his employment men five hundred miles, to the electrical manufacturing plant to learn how to do it.

What they were going to do with it in the oil business, when they had learned it, we didn't find out. But it was simple and practical, and recommended by one of the picked delegates to an industrial relations conference held at a leading university. Therefore, we suppose, they thought it must be pretty good for something.

At this point perhaps we should say, "And so long until tomorrow." (Editor.)

N. Y. Telephone Company's Experience

THE chief purpose of psychological tests of aptitude is to aid in predicting the potentialities of an applicant's success in the occupation being considered. Bingham defines aptitude as "a condition indicative of a person's power to acquire specified behavioral patterns of interest, knowledge and skill. It is a present condition with a forward reference—a condition or set of characteristics regarded as symptomatic, indicative of potentialities."

The problem of "vocational selection" or the selection of suitable applicants for any job is a serious one to every employer. The many and varied types of skilled occupations found in modern industry demand reliable and efficient methods in the hiring and allocation of workers.

Today the New York Telephone Company, representative of the Telephone industry as a whole, has undoubtedly as many varied types of scheduled occupations as will be found in any modern industry.

During the early days of its relatively short term of existence and before the business became too complex, the qualifications most sought in the applicant for employment were a sane mind and a sound body. Those qualifying in these respects were engaged with the knowledge that they could be used readily on some type of work for which they subsequently demonstrated fitness. However, as the business grew the need for employees with specific qualifications arose and in recognition of this need the Company focused greater attention on the selection of its personnel. Employment Bureaus were established and manned by interviewers fitted, by experience, to recognize in the applicant the qualifications peculiar to the vacancy to be filled. In this way, the growing complexity of the business was fairly well met at a cost consistent with the conditions of employment.

Why the Company Started Testing

ON THE introduction of Panel Type Dial Central Offices, with their complicated circuits and delicate equipment, it became apparent that the personal interview in itself was insufficient to determine the applicant's fitness for a complicated job and a series of simple written and mechanical tests covering general aptitude were introduced to substantiate or supplement the judgment of the interviewer. While this innovation increased the percentage of satisfactory selections considerably in the case of potential Dial Central Office Maintenance men (Switchmen), it was apparent that a more accurate and reliable method would be desirable. Coupled with the growing need for the selection of the proper individual for specific jobs, this recognition may well be interpreted as the purpose of this study.

More specifically, the objective was to construct a reliable and valid test battery which would supplement the judgment of the interviewer in the selection of those to be trained for the job of Switchman.

Training Course

THE results of a total of 50 subjects were used in the construction of the test battery. These subjects represent an average cross-section of applicants who presented themselves at the employment office of the New York Telephone Company. They offer various degrees of training ranging from elementary grade to college level of study. No attempt was made to categorize the applicants on the basis of education or skilled training in other fields.

All subjects received the same preliminary training in the Panel Dial School before starting work as switchmen. This training was initiated by a review course in the Elementary Principles of Electricity. The course consisted of three parts; (1) ferromagnetism and electromagnetism, (2) alternating current circuits and (3) current calculations. Here it was observed that a knowledge of arithmetic was essential for success. Of assistance to the student taking the course was any general information concerning the subject matter that he may have acquired by academic training, home study or any other means.

Following the course in principles of electricity the subjects were given a circuit study course which taught the application of the material learned in the first course to a collection of equipment symbolized as wiring diagrams and schematic drawings. The subjects learned to "trace" the wiring systems of the various pieces of equipment and to associate the diagrammatic representations with the original apparatus located in the Panel Dial Central Office. The term "trace" embraces the process of following a line representing a wire until a unit of equipment or an open contact is reached. When an open contact is reached, the line must be retraced to the starting point and a new path chosen. This process readily simulates maze learning of a comparatively high order of complexity. Circuit description sheets are provided as an aid to "tracing" and learning circuit function.

As a corollary to circuit study, short "Relay and Apparatus Courses" were given in which the subjects were taught to operate and adjust the various pieces of equipment using specific adjustment instructions issued by Bell Telephone Laboratories and called Bell System Practices. Upon completion of these courses, the subjects were sent as apprentices to a Central Office to work on the equipment studied.

Tests Based on Training Syllabus

THE construction of the test battery was based on the principles formulated by Hull in the introduction to his book on *Aptitude Testing*. "The most accurate method of determining the aptitude of an individual for a vocation or other activity is the test of life itself. The ultimate test must always be the learning of the vocation in the ordinary manner, after which we may observe the degree of the individual's proficiency when he has reached the limit of his training."

The training period in the Panel Dial School was a fertile source for test infor-

mation. The review course in elementary principles of electricity, divided into (1) ferromagnetism and electromagnetism, (2) alternating current circuits and (3) current calculation, suggested components for the battery. To test this first stage of training a series of 40 items was compiled. It included 31 multiple choice statements based on ferromagnetism, electromagnetism and alternating current circuits and 9 problems concerning current calculation. Although given to the subjects as one test, the scoring was divided into three parts. Test 1 included units 1–14; Test 2, units 14–29; Test 3, units 29–40. Closely associated with these tests was the fourth—an arithmetic test containing 8 problems in addition, subtraction, multiplication and division of fractions and decimals.

The courses in circuit study and relays and apparatus involving circuit tracing and use and adjustment of apparatus were a source of 5 additional tests. Tests 5 and 6 are alike in two ways: first, they are both tests of mechanical aptitude as judged by knowledge of apparatus function and adjustment and, secondly, they both concern the same piece of apparatus. Test 5 consists of a series of 10 questions based on a diagram of a 4-C Buzzer which has its various parts indicated by arrows and numbers. A complete understanding of mechanical function is necessary to answer the questions. Test 6 is made up of 2 types of questions—multiple choice and direct response, and has 12 parts. It is based on instructions for the adjustment of apparatus. The instructions have been prepared by the Department of Development and Research of the Bell Telephone Laboratories, Inc., and are known as Bell System Practices (Apparatus Requirements and Adjustment Procedures).

Complicated Maze Like Complicated Wiring

Circuit function and circuit "tracing" were more difficult to prepare in test form. General intelligence indicators seemed to offer little forecasting ability for this aptitude. Men with electrical engineering degrees were as apt to fail at this point as were more poorly equipped individuals. Tracing is fundamentally trial and error learning. Differing only in degree of complexity from the lower form studied in animals, it should be readily amenable to the same form of measurement used in animal studies—the maze. To test this aptitude, therefore, three mazes were incorporated in the battery as Tests 7, 8 and 9. The subjects were required to trace through from start to finish of the 3 mazes which are successively more complicated and difficult.

The battery of tests was given to students upon their entrance into the Panel Dial School. The testing was conducted under rigidly controlled conditions as regards to instructions, time limit and scoring.

Tests Compared with Ratings

Since the occupational activity of the training period does not lend itself readily to accurate measurement as behavior or product of behavior, the criterion score to be used as a basis of comparison for the aptitude testing was determined by the

ranking method described by Hull and classified by him as "subjective impression criterion." The ranking was done by the instructors in the Dial School. Since each instructor was in personal contact with each student at least once each day, circuit instruction being done on an individual basis, their intimate observations were valuable in the determination of the criterion. Weekly reviews of the standing of the students were held under the direction of the Supervisor of Training. Inasmuch as this was essentially the method of determining whether or not the student was successful in the school before the test battery was considered, the criterion score thus secured was deemed reliable. This procedure was continued until 50 men who had had no previous Panel Dial training had completed their schooling and had been ranked by the Faculty and Supervisor. Where any doubt existed as to the student's place in the ranked series, as might occur when two or more instructors disagreed as to a student's ability, the student was dropped from the study group.

TABLE 1

SHOWING THE CORRELATION COEFFICIENTS OF THE TEST BATTERY, ARRANGED FOR CONVENIENT EXAMINATION

VARIABLE TESTS	VARIABLE NUMBERS								
	0	1	2	3	4	5	6	7	8
1	.420								
2	.456	.639							
3	.462	.622	.655						
4	.518	.479	.592	.472					
5	.347	.518	.453	.454	.431				
6	.486	.582	.546	.534	.564	.609			
7	−.422	−.289	−.093	−.260	−.393	−.437	−.449		
8	−.232	−.251	−.111	−.246	−.411	−.429	−.480	.757	
9	−.257	−.279	−.226	−.292	−.345	.034	−.309	.115	.280

The ranked series of 50 students was then transmuted into units of amount on an ordinary 10 point scale and served as the criterion score for this study.

Statistical Computations

THE computation of correlation coefficients conveniently arranged in Table 1 showed that all tests have a high correlation with the criterion score and a rather high intercorrelation. The latter might have been expected in view of the broad aptitudes for which each test was designed. Since the tests can be given at a low cost, are easily scored and therefore, contribute enough to the prognostic efficiency of the battery as a whole to repay costs incidental to their use, they were all retained. Further evidence in favor of retaining these tests, in spite of high intercorrelation, lies in the fact that these tests which have the highest intercorrelation coefficients (Tests 1, 2, 3, 4, 5 and 6) show stronger correlation with the criterion score than do the three (Tests 7, 8 and 9) with lower intercorrelation.

Taking Out the Dead Wood

As THE next step, the tests were combined in such a way as to yield the best possible aptitude prediction. This step was effected by statistical weighting of each test by use of the multiple regression equation as devised mainly by Tolley and Ezekiel and described by Hull. The equation devised was

$$X_0 = -.21X_1 + .66X_2 + .61X_3 + 1.88X_4 + .007X_5 + 1.09X_6 - .83X_7 + .53X_8 - .08X_9 + 23.70$$

The correlation between the test battery thus weighted and the criterion was derived by the following procedure:

$$(1)\quad R = \sqrt{\frac{Po_1 W_1 + Po_2 W_2 + Po_3 W_3 + Po_4 W_4 \text{ etc.}}{Poo}}$$

$$(2)\quad R = .6778$$

The multiple correlation coefficient is .6778 with a coefficient of reliability of .853. This corresponds to a forecasting efficiency of 27.2 per cent.

TABLE 2

SHOWING SCORE RANGE AND PER CENT OF FAILURES OF 222 MEN TESTED BY THE NEW TEST BATTERY

SCORE RANGE	TOTAL	FAILURE	PER CENT FAILURE
0–9	3	3	100.0
10–19	6	5	83.0
20–29	10	7	70.0
30–39	25	9	36.0
40–49	52	10	19.0
50–59	76	8	10.5
60–69	42	1	2.4
70–79	8	0	00.0

Percentage of Failures

THE test battery has been given to 222 men who have been trained and released to Central Offices as switchmen or have been transferred because of failure to other departments. Table 2 shows the percentage of failures according to score range of these 222 men.

The Panel Dial Aptitude Test Battery has proven to be exceptionally effective in predicting success in the Dial School. Inasmuch as new employees hired for this craft would have to pass successfully through the Dial School, this test battery can be used as an effective employment test. From a study of the 222 men who have taken the test, we can predict that, with a critical score set at 50, we would have 14 failures out of every 135 men employed. If the critical score were set at 60, there would be employed only 1 failure out of every 50 men selected. It must be remembered that to secure 109 men with a score of 50 or better, or 42 men with a score of 60 or better, would require testing 222 men, if the applicants at the employment bureau

were of the caliber of the students sent to the Dial School during the period in which the tests were employed.

Summary and Conclusions

A BATTERY of 9 tests was prepared and given to 50 subjects.

Statistical analysis showed a high correlation between the individual tests as well as high correlation of the tests with the criterion score.

The tests were weighted and computation revealed a multiple correlation coefficient of .6778 with the criterion which corresponds to a forecasting efficiency of 27.2 per cent, a value much higher than yielded by most aptitude tests.

Although the tests of the battery are by design broad in function and tend to measure overlapping function, they were not radically changed because of the simplicity of administration and scoring and the relatively low cost involved.

The writers wish to express their indebtedness to Mr. J. W. Humphreys and Mr. E. A. Staples of the New York Telephone Co., Long Island Area, for cooperation and assistance in the preparation of the Test Battery and to Professor Clark L. Hull for reading and criticizing the manuscript.

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Researches are Usually Impossible Because of a Foolish Convention that Institutions Engaging in Industrial Research are Expected to Pay their Way or Earn their Keep. This Confusion of Research with Commercial Huckstering can Never Prosper.

Personnel Research Federation

Report to Engineering Foundation
By The Director

The Personnel Research Federation was founded in 1921 under the primary sponsorship of the Engineering Foundation and the National Research Council. Its main purpose was to further the development of scientific studies of human problems, particularly in industry, so that there might be a parallel development with the progress of engineering science.

Since the time of its foundation, in addition to grants from the Engineering Foundation, the Federation has received and spent $300,000. These funds have been in the form of supporting contributions, research grants, fees, and membership dues.

Main Accomplishments

The main accomplishments of the Federation are briefly described and some attempt made at appraising their value below:

(1) The first job was to make an intensive survey of employment methods then in use in industry, and the scientific knowledge available by the use of which industry might improve its methods. The results of this study were published in book form, sold widely and became the standard reference manual in major companies. It also became a standard text for use in engineering and other colleges.

(2) This study showed among other things that through misunderstandings of motives, many workers restrict their output. A special study was then made of the prevalence of this, the reasons for it, and what might be done to improve understanding between workers and management. The results of this study were published in book form and widely sold, for use in industry and schools.

(3) A study was then made of the best ways of making sure that misunderstandings are minimized through improved methods of ascertaining employee viewpoints—particularly when talking with them, or interviewing them. This was also published in book form, and ran into more than one edition.

Helps Company Save $5,000,000

(4) In 1926 the Federation commenced its major study into the causes of accidents among the bus and streetcar operators of the Boston Elevated Railway. This lasted five years, the Federation training the company personnel in the safety measures developed, so that they could carry on. The results of this work have resulted in the Company three times winning the Anthony N. Brady award as the safest transportation company in the country, and obtaining an actual cumulative cash saving in accident costs of over $5,000,000.

(5) The statistical and theoretic findings basic to the Boston Elevated work having come to the attention of a group of insurance companies writing automobile accident insurance the Federation was asked to make a study of motor vehicle operators in Connecticut. This study led to the formulation of a new basis for premiums on automobile insurance, which is a contributing factor to the decreasing number of auto deaths of recent years.

(6) When the Highway Research Board of the National Research Council undertook to extend these studies further, they called upon the Federation for consultation, and used the Federation studies as basic in their analyses. The National Safety Council has also made extensive use of the Federation material. It may be fairly claimed therefore that the Federation work is a useful contribution, which has aided in the development of safety science, which is succeeding today.

(7) The Federation next received a grant to study the possibilities of developing accurate occupational trends, so that young people might prepare themselves to enter growing occupations and avoid declining ones. The methods of statistical analysis suggested by the Federation have been used in two regional studies, made by other agencies, and are used by the U. S. Office of Education.

Aids Smooth Labor Relations

(8) Under direct grants from the Engineering Foundation the Federation made a series of studies of ways and means of developing and maintaining peaceful relations with employees in the recent years of unionizing activity. These studies were published in the Personnel Journal and received wide attention. Many thousands of reprints of them were bought by companies for distribution among their executives.

(9) The Federation has edited and published a magazine called the PERSONNEL JOURNAL. This is now in its 18th volume. This magazine goes to over 500 engi-

neering, business and liberal arts colleges, where it is used for classroom instruction. The Journal also goes into some 1200 companies, where it is used by executives to keep them up to date in new scientific findings in economics, psychology, and related social sciences, and in the ways in which they may apply these findings practically.

Member Companies Strike Free

THE value of the Journal may be difficult to appraise. Its circulation has been constantly expanding. A study made in 1937 showed at that time that no company which was a member of the Federation and took the magazine, had had any labor trouble leading to a strike. How far they were aided in maintaining smooth relations with their employees because they had incorporated in their policies and practices the scientific analyses published in the Journal over the years is not known. But it seems more than a coincidence that companies taking the Journal were strike free. Since that time many companies who have had trouble are turning to the Federation directly and through the Journal for aid.

(10) In 1921 there were not fifty companies in the country with personnel departments using scientific methods of personnel work. Today there are at least 1500. There are perhaps 100 now with personnel research departments of their own. The Federation may claim to have aided in this growth, through its magazine, its conferences, its personnel's contacts with company executives, and its researches.

(11) Thus the foresight and wisdom of the Engineering Foundation has been amply justified. The Foundation saw that an organization such as the Personnel Research Federation would be needed, and that once started with the aid of the Foundation, others would join in its support, so that the Foundation could withdraw, and devote its funds to other pioneering enterprises. This is exactly what has happened.

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